Intellectual challenges to financial stability analysis in the era of macroprudential oversight

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This article discusses the main intellectual challenges related to the conceptual foundations, analytical models and regulatory assessment tools in the field of financial stability analysis. The focus is on ways to detect and contain systemic risk. The article also tries to point in directions that could be helpful in resolving these intellectual challenges. The article starts with a discussion of the nature and origins of financial stability and systemic risk. It then goes through four areas in which lessons from the present crisis have illustrated major analytical challenges in enhancing the understanding of financial stability and systemic risk.

The article concludes that 1) the understanding of the fundamental working of financial systems and the risks they generate needs to be deepened, in particular in relation to financial innovation and the role of nonbank financial intermediaries, 2) better insights need to be developed about when and how financial systems migrate from stability to instability, 3) models need to be developed that capture the interactions between widespread financial instability and the performance of the economy at large (including the related amplification effects and nonlinearities), and 4) such models need to be further extended to be able to assess the effectiveness and efficiency of macroprudential regulatory policies in containing systemic risks.

Meeting this agenda will require reorienting significant resources in academia, central banks and supervisory authorities in these directions. It will also require enriching the way of thinking in economics and finance. New approaches should be considered that do not necessarily rely only on the notions of equilibrium, universal rationality and efficiency, but go beyond those concepts. Approaches that have been used successfully in other fields, such as the natural sciences, may be a helpful source of inspiration.

This article discusses the main intellectual challenges related to the conceptual foundations, analytical models and regulatory assessment tools in the field of financial stability analysis. The focus is on ways to detect and contain systemic risk. The article also tries to point in directions that could be helpful in resolving these intellectual challenges. The new supervisory bodies that have just been created in Europe –such as notably the European Systemic Risk Board (ESRB) in the European System of Financial Supervision (ESFS)– would benefit significantly from intellectual progress in those directions.

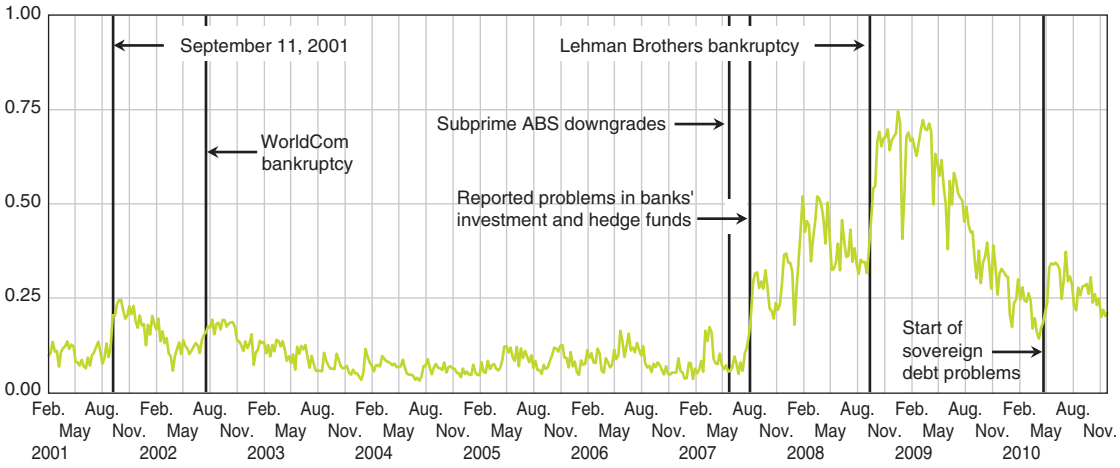
The article starts with a discussion of the nature and origins of financial stability and systemic risk, in particular how systemic risk can be defined and which factors can make financial instability widespread and dangerous. It then goes through four areas in which lessons from the present crisis have illustrated major analytical challenges in enhancing our understanding of financial stability and systemic risk. The first area concerns challenges at the very fundamental level of the functioning of financial systems, in particular how they change over time through innovation. The second area relates to challenges with respect to our understanding of the transition from tranquil times to crisis times. Third, it is extremely challenging to develop better tools assessing the macroeconomic implications of financial instabilities. Fourth and last, we have very limited analytical tools and models (and experiences) to assess how regulatory policy can be used to contain risks *at the level of the financial system as a whole* and the overall economy. The article ends with some concluding remarks.

1| Financial crises, stability and systemic risk

1|1 The meaning of systemic risk and experiences with systemic crises

The crisis that we have experienced over the last three years is an overwhelming case of the materialisation of systemic risk. Systemic financial risk can be defined as the risk that financial instability becomes so widespread that it impairs the functioning of a financial system to the point where economic growth and welfare suffer materially.[1] Chart 1 displays one indicator –a Composite Indicator of Systemic Stress (CISS)– that ECB staff developed to capture in real time how much systemic instability is present at a given point

Chart 1
Systemic instability in the European Union



Note: The chart shows the Composite Indicator of Systemic Stress (CISS; see Hollo et al.*, 2010) between 2001 and 2010. The CISS is constructed from several measures of instability for each of five components; money markets, bond markets, equity markets, foreign exchange markets and financial intermediaries. The five components are aggregated and weighted considering the correlation among each other (systemic dimension) and their correlation with industrial production (real economy dimension). The indicator is normalised between 0 (no systemic stress) and 1 (maximum systemic stress). It is calculated in real time using weekly data.*

1 *ECB (2009).*

in time.[2] The chart clearly shows how systemic stress emerged in the European Union in August 2007, how the situation degenerated to a full-blown systemic crisis in September 2008 with, in particular, the bankruptcy of Lehman Brothers (when the indicator shoots up towards its maximum value of 1) and how the process of relaxation was countered in May 2010, in particular due to the Greek debt crisis.

There were many financial crises in history and a share of them reached systemic dimensions. Examples include in particular the world's Great Depression in the 1930s and, at national levels, the Nordic and Japanese banking crises during the 1990s.

Every crisis possesses its own characteristics, and having learnt the lessons from the last crisis does not provide protection against future, necessarily different, crises. Moreover, in a dynamic economic system, progress and growth can only be achieved in accepting risks, which could indeed include a "tail risk" of crises.

The experience of the last three years suggests that policy authorities in all advanced economies need to improve considerably their capacity to detect and contain systemic risks. Financial supervision was too much focused on the microprudential dimension of individual risks at the level of single intermediaries and markets, rather than looking how risks could add up and compound each other. In order to become better in this regard, authorities need to consider more the deep underlying sources of systemic instability and, in particular, how risks can reach the systemic dimension.

1|2 How financial instability can become systemic

Research suggests that there are, in particular, three broad ways through which financial instability can reach systemic dimensions.[3]

The first is contagion. The failure of one financial agent (or crash of one market) can lead to failures of other financial agents (or crashes of other markets), even when the latter have not invested in (or are exposed to) the same risks and are not subject to the same original shock as the former.[4]

Second, widespread financial imbalances can build up over time and then unwind abruptly. Hyman Minsky described how in good times consumption and investment increase, generating income, which fuels the financing of more consumption and investment but also the neglect of increasing risks. Even small events can then lead to a re-pricing of risk and an endogenous unravelling of the credit boom, which adversely affects many agents and markets at the same time.[5]

Third, severe negative aggregate shocks can adversely affect intermediaries and markets simultaneously. Historical research has shown that many banking crises were related to severe economic downturns.[6] Note that the three mechanisms can happen independently, but that most of the time they are mutually reinforcing.

There are a number of inherent features of financial systems that make them particularly prone to these forms of systemic risk.

The first is externalities. They particularly relate to the complex and dynamic network of exposures among major intermediaries. What in tranquil times is an efficient mechanism to share risk, can, in times of stress, become a dangerous channel for transmitting instability. Two contracting parties do not have an incentive to take account of the effects of their risk-taking on third parties. As a consequence, the risk at the level of the system may be higher than the sum of perceived individual risks.

The second feature is asymmetric information. Financial systems allocate funds from agents who have them but possess no specific knowledge about promising investment opportunities, to agents who have knowledge about the opportunities but not the funds to engage in them. This creates an agency problem between the two parties, which may be handled more or less well through the underlying financial contracts. If contracts are incomplete and negative news arrive

2 *Hollo, Kremer and Lo Duca (2010). The indicator combines instability of different financial markets and intermediaries, including their links to economic activity. Many previous systemic risk indicators focused on the banking system using market data (Avesani, 2005; Hartmann, Straetmans and de Vries, 2006; Segoviano and Goodhart, 2009).*
3 *De Bandt, Hartmann and Peydro (2009) and Trichet (2009).*
4 *Allen and Gale (2000), Freixas, Parigi and Rochet (2000) and Chen (1999).*
5 *Minsky (1977) and Kindleberger (1978).*
6 *Gorton (1988) and Demirgüc-Kunt and Detragiache (1998).*

on some of the investment projects, but information asymmetries do not allow lenders to judge whether this also affects other investment projects, funding may evaporate for all projects alike –a phenomenon often referred to as adverse selection.[7]

The special propensity of financial systems to systemic risk is not simply the result of these two imperfections. Externalities and information problems are also present in other economic sectors. But there are some other features of financial systems, which render their implications much more severe and widespread. First, illiquid assets, maturity mismatches between assets and liabilities and leverage amplify the force with which problems of one financial intermediary are pushed through the complex network of exposures. Second, sizable amounts of debt relative to capital and short-term funding have more dramatic effects in situations of stress. These features in conjunction with the above imperfections lead to powerful feedback and amplification mechanisms, which may cause sudden regime changes, driving the system from a state of relative tranquillity to a state of turmoil (see, for example, the soaring values of the CISS in August 2007 and September 2008 in Chart 1). In the aggregate, one observes the abrupt nonlinear adjustments that are so characteristic of financial instability.

A well-developed analytical apparatus for supporting policies in this area would have to fully capture all these elements. The following sections try to address some of the intellectual challenges in providing such an apparatus, using the experiences of the present and previous crises.

2| Advancing the analytical apparatus for financial stability and systemic risk policies

2|1 The basic functioning of financial systems and the risks they imply

The first set of intellectual challenges in advancing the analytical apparatus for financial stability and systemic risk policies relates to the deep functioning of financial systems. The crisis has shown that financial systems are much less understood than what was thought. While some important parts and implications of the "DNA" of financial systems are known –their main components, their main functions, indicators of their efficiency or which basic risks can emerge–, there are difficulties in grasping the essence of some major mutations ("financial innovations") and in predicting how the overall body reacts to specific stresses; two elements that, on occasion, may be strongly related.

The crisis has taught authorities (and market participants) that the early identification of the build-up of vulnerabilities and widespread imbalances has to become better. The analytical apparatus supporting financial stability policy needs to provide authorities with the means to understand the efficiency and risks of both new financial instruments and new business models of financial intermediaries.

A second crisis lesson in this area is that not only models about the systemic risks in banking are needed but also about how nonbank financial intermediaries can contribute to the transmission of instability at the system level. Brunnermeier and Nagel (2004) found that, whilst hedge funds are technically among the most sophisticated investors, between 1998 and 2000 they were heavily invested in technology stocks rather than acting as a price correcting force towards fundamental values. More generally, the explosion of the industry of highly leveraged financial institutions over the last 20 years –from around 100 billion US dollars capital under management in 1990 up to 3 trillion US dollars in 2007– is not yet fully understood in its financial stability implications.[8] Also to be noted, the credit derivative activities of some insurance companies did play a significant role in the crisis. The activities of so-called shadow banks, which were not subject to the supervisory regime of banks, played themselves a decisive role in the run up to the subprime crisis, which has been the trigger of the global financial crisis.

A third lesson suggests that the image of atomistic and highly efficient financial markets needs to be revised. As also a growing body of financial research suggests,

7 *Stiglitz and Weiss (1981).*
8 *Thurner, Farmer and Geanakoplos (2010) illustrate with an agent-based model (see below) how leveraged purchases of under-valued assets by funds can amplify asset price fluctuations.*

asset valuations, corporate financing activities and intermediation processes are subject to a range of important imperfections to which greater attention is warranted. The two examples of externalities and asymmetric information have already been mentioned. Another example is oligopolistic structures in major wholesale financial markets. Many derivatives markets are dominated by a small number of highly sophisticated and complex financial intermediaries. Their strategic behaviour is likely to have very different effects on those markets than the benchmark of perfect and atomistic markets might suggest. How this strategic, and maybe sometimes also predatory behaviour can –on occasion– have destabilising effects needs to be understood much better.

A more radical line of work responds to analytical challenges of the crisis at a more fundamental theoretical level. It starts from the presumption that certain inherent features of the standard economic paradigms, in particular in macroeconomics (see also sub-section 4|3 below), prevent them from capturing crucial features of exceptional situations like the ones experienced in the last few years. Notably, analytical models based on a strong tendency to converge towards equilibrium, a high level of market efficiency and representative rational agents have great difficulties in generating the amplification effects, nonlinearities and crashes characteristic for systemic instability (see Section 1 and Chart 1).[9] So-called agent-based models do not rely on strong equilibrium attractors and incorporate heterogeneous agents whose direct interactions have significant influence on overall economic outcomes.[10] They are based on bottom-up simulations of individual behaviour rather than top-down maximisations. They have been applied successfully to a wide range of problems in different sciences, including physics, biology, computer science, traffic systems and mass panics, in particular to problems where amplification, intermittent changes and nonlinearities play a significant role. It will be interesting to see to which extent the nascent applications to systemic risk can contribute to meet some of the challenges discussed below. Seen from the perspective of public authorities experiencing a crisis, which have to take swift and non-standard decisions in an environment of generalised nonlinearities, significant advances in this new analytical field are of the essence.

2|2 The transition from tranquil times to crises

The second set of intellectual challenges for financial stability analysis relates to the period in which the system moves from stability to instability. One distinguishing feature of this crisis relative to previous crises is speed. While the unfolding of the sovereign debt crises in the 1980's occurred over the course of years, the Asian financial crisis developed, at its peak, over months rather than years. The major intensification of the present crisis, starting in mid-September 2008 (see Chart 1), spread around the globe in the course of half-days.

In physics such phenomena are described as phase transitions. When some factors exceed a critical level, a system behaves qualitatively differently from a situation when the factors stay below this level. Building on some fundamental physics research on "crackling noise" and "self-organised criticality",[11] Bouchaud (2009) describes how the random field Ising model –originally developed to analyse how spins order within a disordered magnet– can be applied to the persistence and breakdowns of financial bubbles. Investors take their decisions based on slowly moving fundamental variables, such as interest rates, inflation, earnings forecasts etc. At the same time, however, they are influenced by the majority opinion of other investors. For that latter fact, the aggregate opinion can be subject to large discontinuous changes, even though dramatic changes do not necessarily happen in the fundamentals. Moreover, the physics analogy illustrates hysteresis in optimism. Much as supersaturated vapour refuses to turn into a liquid, optimism is self-consistently maintained (until a critical threshold is reached and an "avalanche" of opinion changes is launched). This analogy from physics illustrates how imbalances that have built up endogenously over an extended period of time can suddenly unravel (see sub-section 1|2).

Another lesson in this area concerns the role of confidence. Ultimately financial transactions rely on promises about future payments. If agents begin to doubt such promises, trust may vanish triggering sharp drops in asset valuations. Arguably, this is even more the case in a highly complex and interconnected system, such as the one that decades of financial

9 *See Farmer and Geanakoplos (2008) for a balanced discussion of the pros and cons of equilibrium economics.*
10 *See, for example, Farmer and Foley (2009) or LeBaron (2006).*
11 *Sethna, Dahmen and Myers (2001) and Bak, Tang and Wiesenfeld (1988), respectively.*

deepening and sophistication have rendered. But the non-fundamental factors that also determine whether financial agents have confidence in the payment promises embedded in such a complex system are hard to characterise in quantitative models. More generally in practice, it is challenging to assess how and when confidence abruptly evaporates at a very large scale, as it did for example in September 2008 after the demise of Lehman Brothers (see Chart 1).

One direction is the analysis of asymmetric and imperfect information. For example, recent research has illustrated which factors generate adverse selection phenomena, so that markets dry up and instability propagates through contagion.[12] Another direction is a greater incorporation of psychological factors in economic analyses, as actually the field of behavioural finance is starting to do. Whereas the former approach still relies on the assumption of fully rational agents, the latter approach starts from empirical evidence that contradicts this assumption. Akerlof and Shiller (2009) discuss a variety of psychological factors that played a role in the present crisis, and much more work would appear beneficial.[13]

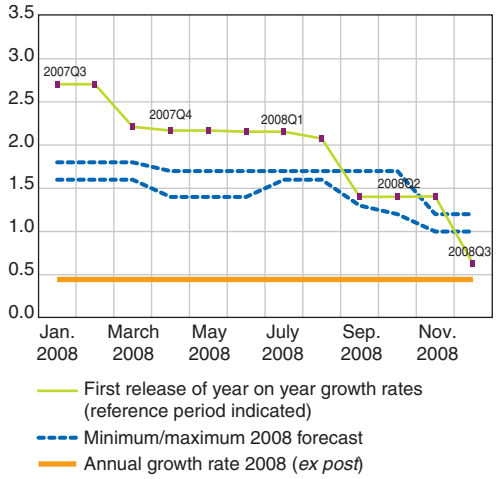
The combination of complexity, interconnectedness, payment promises in debt contracts, limits of information and basic human behaviour –"animal spirits"– can lead to the violent feedback and amplification mechanisms that are so typical for the transition from stability to instability. For all these reasons, enhanced and deep market intelligence should continue to play a very substantial role.

2|3 Financial crises and the macroeconomy

The third area of intellectual challenges in financial stability analysis relates to why authorities care so much about financial stability, namely to which extent financial instability affects the overall economy, notably growth and consumer welfare, and why the transmission to the real economy may sometimes be so severe. Chart 2 shows the range of GDP growth forecasts for the euro area across major forecasting institutions (dashed blue line) and the realised GDP growth rates (solid orange line)

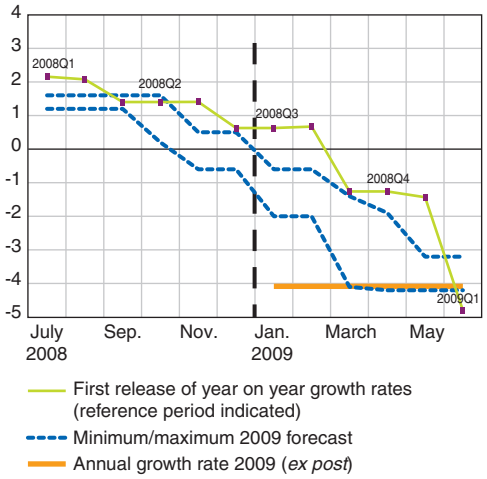
Chart 2
Real time euro area GDP growth forecast errors and coincident growth releases
(%)

a) For 2008



Note: Panel a) compares the range of euro area GDP forecasts released during 2008 for the full year 2008 (corridor of dashed blue lines) with the ultimately measured 2008 GDP (solid orange line). The difference between the two is the forecast error.

b) For 2009



Note: Panel b) compares the range of euro area GDP forecasts released between July 2008 and June 2009 for the full year 2009 (corridor of dashed blue lines) with the ultimately measured 2009 GDP (solid orange line). The difference between the two is the forecast error.

Both panels also report year-on-year euro area GDP growth releases by Eurostat for the period ending at the quarter indicated (solid green line). The horizontal axes refer to the month of the respective release, except for the ultimate 2008 and 2009 GDP growth rates. The range of GDP forecasts is derived from the maximum and minimum point forecasts considering releases by the European Commission, IMF, OECD, Economist Consensus Forecast, Eurobarometer and Survey of Professional Forecasters. All growth rates are in per cent.

12 *See, for example, Heider, Hoerova and Holthausen (2009) or Morris and Shin (2010).*
13 *See also Barberis (2009) or Shefrin (2010).*

as policy makers saw them during the "critical" years of 2008 and 2009, respectively. By comparing the corridor of dashed lines and the solid orange line in panel a) of Chart 2 one can see that all forecasting institutions consistently over-estimated the growth rate for 2008, even until very late the same year. Moving on to panel b) of Chart 2, it can be seen that the strongly negative growth rate of – 4% in 2009 –the "free fall" in economic activity– was dramatically missed until the end of 2008. In this sense, left alone with unreliable forecasts policy-makers had to act on informal information, real-time data releases and their own wisdom and judgements on how the situation was evolving.

There can be many reasons for these sizable forecasting errors. One may simply be that it is particularly difficult to look into the future in extraordinary circumstances. It would, however, be too simple to just stop here. Another reason for the errors may be that standard macroeconomic models, as they tend to be used as input in projections, do not have well developed financial sectors and are mostly linear in nature. Therefore, it is not all that surprising that they were not able to predict the drastic effects of the financial meltdown on growth figures. So, a tremendous intellectual challenge is to develop aggregate models that (i) give the central role to financial systems that they actually play in the economy by channelling funds from firms, households and governments with surpluses to the agents that need them to finance real investment and smoothen consumption and (ii) incorporate states of widespread instability in these financial systems that feature the characteristics discussed before (bank defaults and other nonlinearities, feedback and amplification effects etc.). Although a new literature of macroeconomic models with "financial frictions" is emerging, we are presently still very far from a new generation of macroeconomic models that would fully meet the challenge described.[14] As this fundamental research field advances, such models could also enrich the toolkit for macroeconomic forecasts.

A related challenge can be identified in the very important field of macro-stress testing. A traditional stress test starts from an extreme but plausible macroeconomic scenario and considers its one-off effect on banks. Looking ahead, stress-testing frameworks could consider the two-way relationship between the financial system and the economy at large. For example, severely weakened banks have less room for lending with negative effects on consumption and investments. Again, cumulative effects and amplifications can take place in practice, which would not be captured by the traditional approaches. Therefore, the type of aggregate models described before could also enrich stress-testing toolkits.

2|4 The regulation of systemic risk

The fourth and last set of intellectual challenges addressed in this article deals with regulatory policy. How can we assess in advance whether regulatory measures have the desired stabilising effects at the level of the financial system as a whole? This is a surprisingly new question. Most financial regulations in the past have been assessed at the microprudential level, namely for their effect on individual intermediaries or markets. Absent aggregate models with realistic characterisations of widespread financial instability, how can we design new macroprudential regulatory policy instruments and calibrate instruments known from the microprudential arena for the desirable effects on systemic stability and welfare?

Some results from the theory of complex systems might be read in a way that those systems cannot be steered with precision. As a consequence, the efficient solution could be to ensure that agents in the system have sizable buffers in order to survive even extreme shocks rather than to try and remove or limit the risks directly. Determining how high those buffers should be is a demanding question. The view embedded into the new Basel III capital and liquidity framework is that such buffers need to be higher than was previously the case.[15]

Although the new standards foresee a multitude of micro-based regulatory measures, they also entail macroprudential elements. These regulatory measures have been developed in response to the major flaws identified during the crisis, namely the insufficient quantity and quality of the capital base of financial institutions, the underestimation of liquidity risk as well as the build-up of excessive leverage

14 *See ECB (2010) for a survey of the literature and a more detailed description of the challenges ahead and sub-section 2|1 for the agent-based modelling approach as an alternative to standard macroeconomics.*
15 *This framework was recently endorsed by the Governors and Heads of Supervision (Basel Committee on Banking Supervision, 2010 b, c and d).*

in the financial system (one of the imbalances referred to in sub-section 1|2). In addition to meeting stricter regulatory requirements with regard to the quantity and quality of regulatory capital as well as liquidity cushions, banks will need to build up additional capital buffers in good times that could be drawn down in stress periods. A capital conservation buffer will serve as a "backstop" against excessive distributions in the form of dividends and compensation payments in good times. Excessive distributions may have contributed to destabilising the financial sector as a whole in the recent past. The capital conservation buffer will be complemented with a counter-cyclical element that explicitly considers the macrofinancial environment (e.g. excess aggregate credit growth) in which financial intermediaries operate. This capital buffer regime is expected to contribute to mitigating the inherent pro-cyclicality in the financial sector (potentially constituting building-up and unravelling of widespread imbalances).

Beyond pro-cyclicality reflecting the build-up and unravelling of widespread imbalances as one form of systemic risk, regulators are increasingly concerned about the interconnectedness among systemically important financial institutions (SIFIs) and the sizable externalities that these financial intermediaries can exert on other intermediaries and the system as a whole (see Section 1). Economists have suggested recently that these intermediaries should hold higher capital or pay a tax or levy, respectively, in proportion to the risk of such externalities.[16] They argued that if the amount of capital or the size of the tax/levy was determined by leverage, maturity mismatch and asset growth, then it would discourage intermediaries to become the source of such externalities. In practice, however, the sources and variants of such externalities are multiple and diverse. Recent policy debates show how complex and challenging it is to introduce such capital or liquidity surcharges in the present regulatory setup, not the least because of the difficulty to precisely and comprehensively measure all the externalities (systemic impact).

Regulatory initiatives at the international level revolve around the following cornerstones: (i) reducing the probability of the failure of SIFIs; (ii) reducing the impact of their failure; (iii) enhancing their supervision and (iv) strengthening core financial infrastructures.[17] A broad consensus has arisen about the need for SIFIs to have higher loss absorbency –commensurate to their systemic importance– compared to non-systemic firms. Key work is under way on the identification of SIFIs and the assessment of the magnitude of additional loss absorbency, to be achieved via a combination of equity surcharges as well as other innovative instruments, such as contingent capital and bail-in-able debt. In parallel, major efforts are ongoing to improve the resolvability of SIFIs.[18] Prominent examples in this area are the establishment of effective resolution regimes, the development of recovery and resolution plans ("living wills") and the creation of dedicated resolution funds.

To address the issue of linkages and contagion, there is also a general drive towards directing trades to Central Clearing Counterparties (CCPs) whenever possible. This way counterparty risk can be managed more efficiently and policies on haircuts can be more effective. The growth of CCPs into highly systemic institutions, however, calls for their tight supervision.

Finally, the recognition that the quality, quantity and timeliness of information are crucial for a sound and stable financial system is driving efforts to improve data collection,[19] develop stress tests into a truly macroprudential tool that fits into a policy framework aimed at advancing the system's resilience, and work on the harmonisation of accounting standards that reflect as closely as possible the economic value of contracts.

Another reminder of the present crisis is the danger of excessive debt and leverage. For example, we know that the debt financing of a wide range of economic agents (from households to large and complex intermediaries) without enough income, equity or collateral was a major cause of the instability. Since one locus of this problem was the heavy flow of credit into mortgage markets in a number of important countries, one should not neglect tools such as loan-to-value ratios and debt-to-income limits. Some Asian emerging countries have some interesting

16 *Brunnermeier* et al. *(2009) and Perotti and Suarez (2009). Market friendly measures have also been suggested to help ease funding pressures on banks during a systemic liquidity crisis, but they need more work before becoming operational (Nicoletti-Altimari and Salleo, 2010).*
17 *Financial Stability Board (2010).*
18 *Basel Committee on Banking Supervision (2010 a) and European Commission (2010).*
19 *See, for example, the mandate of Office for Financial Research set up by the United States.*

experiences with the use of such demand-side oriented macroprudential policy instruments.[20] We should reflect on whether the positive experiences of those countries with tightening limits would justify generalising them as fully countercyclical instruments (also relaxing them in downturns). And whether these experiences in emerging economies of relatively moderate size would be fully valid for sizable industrial countries with highly developed financial systems.

From an institutional perspective, Europe has pushed ahead with the creation of the ESRB, a body responsible for the macroprudential oversight of the financial system within the European Union. The ESRB will monitor systemic risk and, when necessary, issue warnings and policy recommendations both about the current situation and the medium-long term, starting with the toolbox described above and working on new instruments suited to industry developments. The strength of this new institution comes from its membership, which comprises all the EU central banks and financial supervision authorities plus the Commission and a representative of the Council's structures. This should ensure that micro- and macroprudential concerns are tackled in a harmonised way and that its recommendations carry due weight. The ESRB starts at a time that calls both for crisis management and for prevention. It was the right time to put in place such a building block of a truly stable and efficient financial system.

The issue of adequate policy responses to emerging systemic risks becomes even more challenging in the international arena. Lately, global imbalances have been reconfirmed and could further widen in the future.[21] While a detailed discussion of this specific issue is more the topic of other papers in this volume and goes beyond the scope of this article, we need to think more about how to make the international monetary system more resilient to such imbalances and policy structures more flexible in addressing them more effectively than the case in the past.

Identifying and mitigating systemic risk is the key challenge for policy makers in the era of macroprudential oversight, which has just started. This requires analytical frameworks and tools to understand and counter it. Authorities need to deepen their understanding of the fundamental working of financial systems and the risks they generate. They need to develop a better assessment of when and how systems migrate from stability to instability. They need to develop models that truly capture the interactions between widespread financial instability, aggregate consumption, investment and growth. And, they need to further extend the latter to be able to assess the effectiveness and efficiency of regulatory policies in containing systemic risks.

Meeting this tall agenda will be challenging in the years ahead. It will require reorienting significant resources in academia, central banks and supervisory authorities in these directions. It will also require enriching the way of thinking in economics and finance. New approaches should be considered that do not necessarily rely only on the notions of equilibrium, universal rationality and efficiency, but go beyond those concepts. Approaches that have been used successfully in other fields, such as the natural sciences, may be a helpful source of inspiration.

The ESCB has launched a large research effort in order to extend the analytical apparatus available in our central banks. We call it the MaRs, for Macroprudential Research network. Many researchers from all EU central banks are contributing to it, following three work areas: 1) macrofinancial models linking financial stability and the performance of the economy; 2) early warning systems and systemic risk indicators; and 3) assessing contagion risks. MaRs will report on its main results in 2012 and until then intensify exchanges with academics and researchers outside central banks.

20 *See Committee on the Global Financial System (2010) for an overview of the actual use of these and other macroprudential policy instruments in the past.*
21 *See Boissay (2010) for a recent paper on the origins of such imbalances and their role for financial stability.*

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